No. 683,406. Patented Sept. 24, 1901.

F. W. JAEGER.

DISCOIDAL ENGINE.

(Application filed Feb. 7, 1901.)

(No Model.)

Fig. 1.

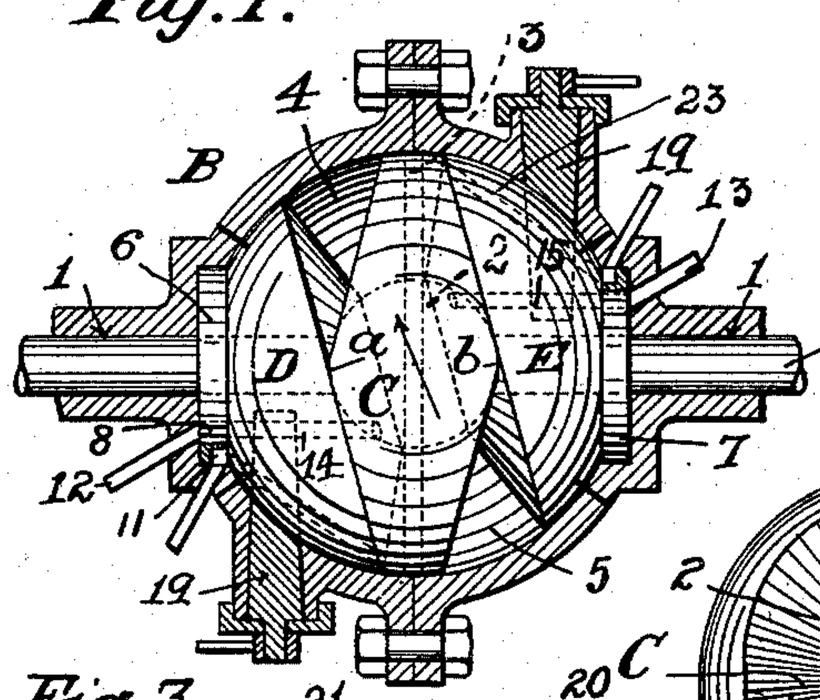


Fig. 2.

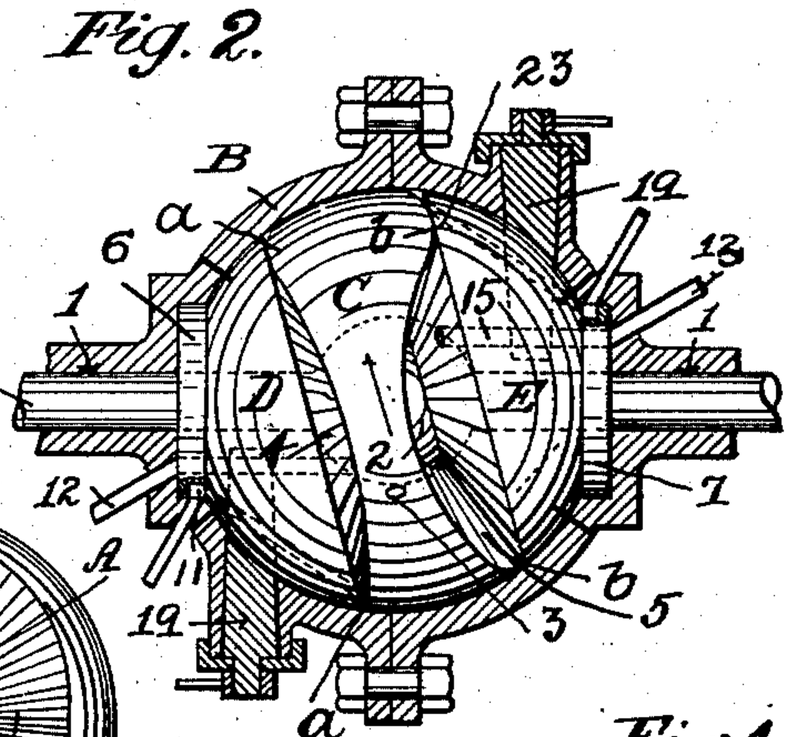


Fig. 7.

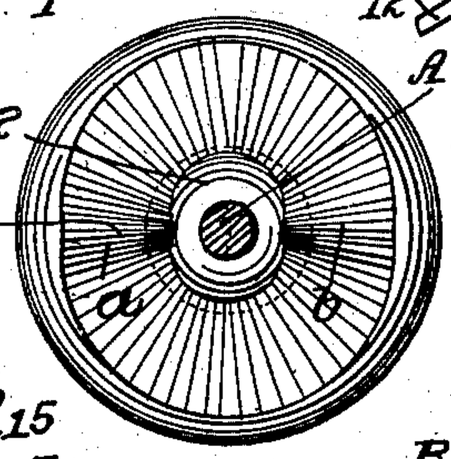


Fig. 3.

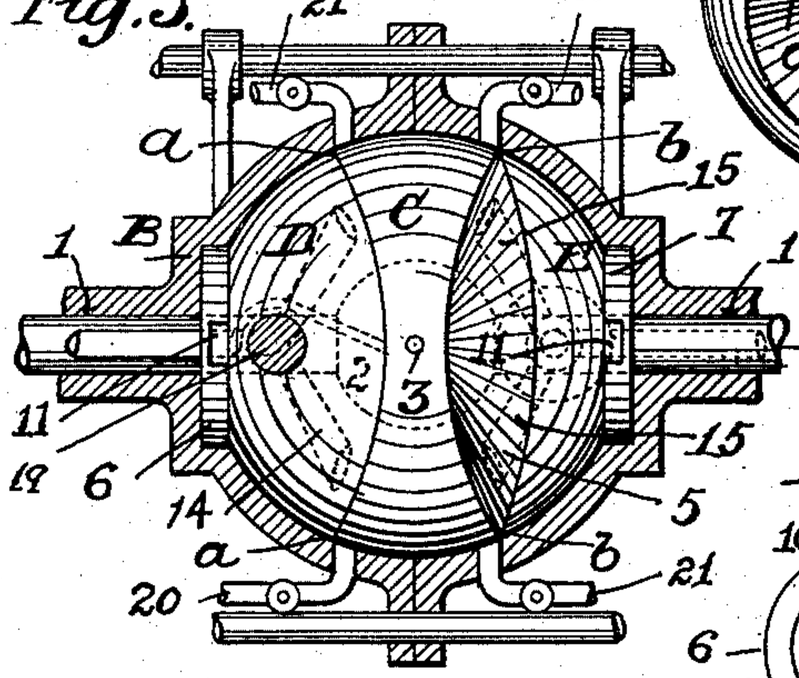


Fig. 4.

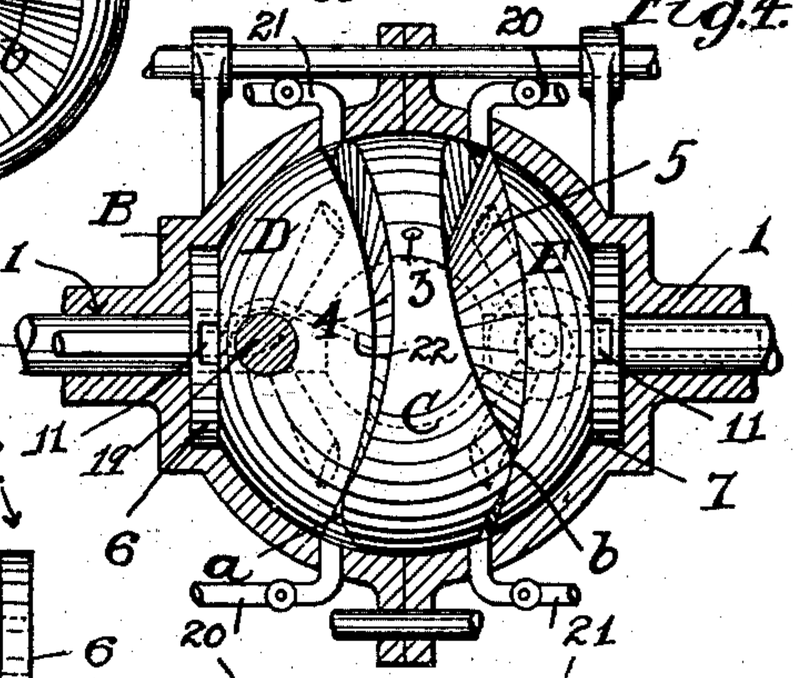


Fig. 9.

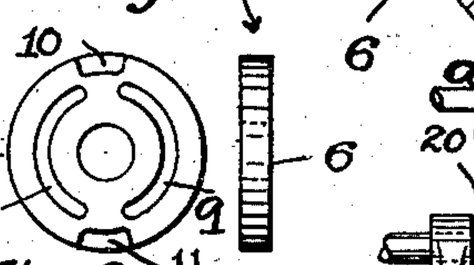


Fig. 5.

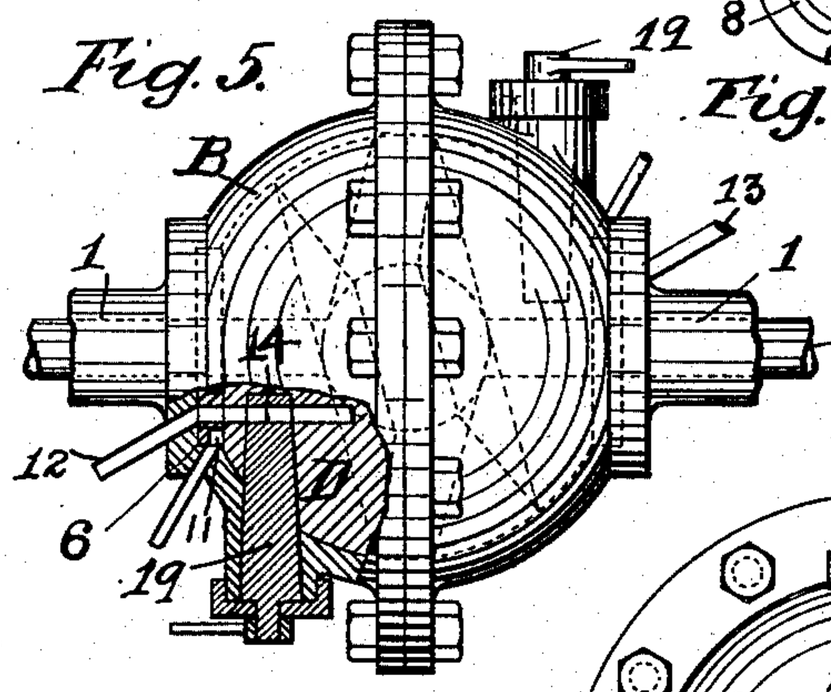
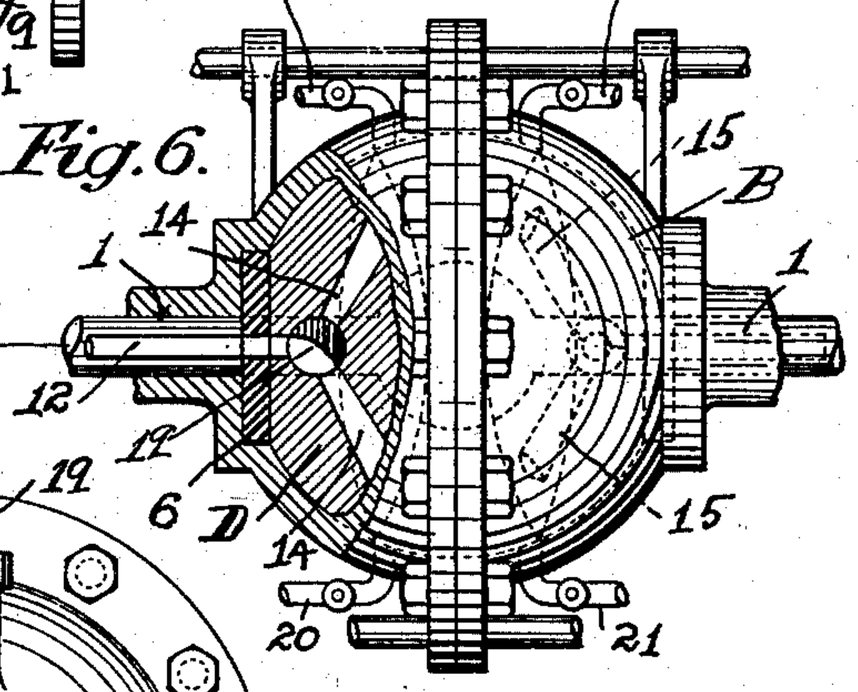


Fig. 8.

Fig. 6.



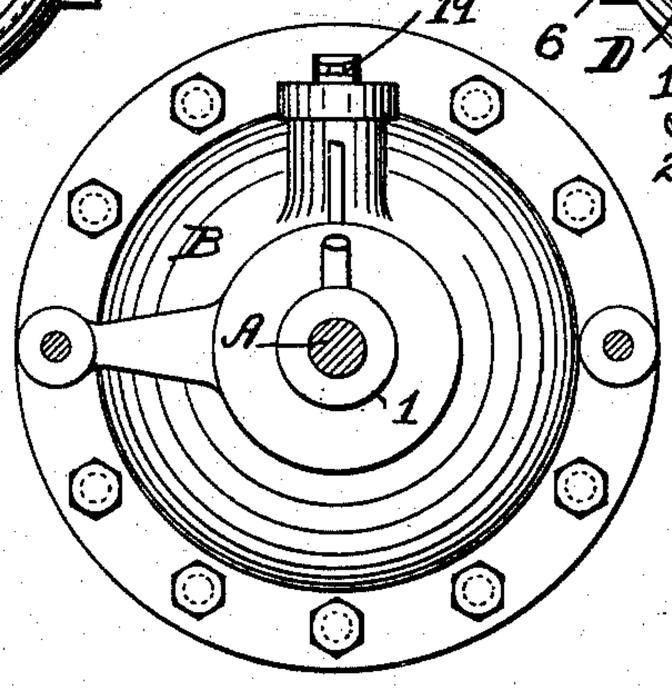


Fig. 10.

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UNITED STATES PATENT OFFICE.

FREDERICK W. JAEGER, OF NEW YORK, N. Y.

DISCOIDAL ENGINE.

SPECIFICATION forming part of Letters Patent No. 683,406, dated September 24, 1901.

Application filed February 7, 1901. Serial No. 46,307. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. JAEGER, a citizen of the United States of America, residing at the borough of Manhattan, New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Discoidal Engines, of which the following is a specification.

My invention has reference to improvements in disk engines—such, for instance, as that known as the "Bishop" engine and described by Rankine in *The Steam Engine and Other Prime Movers*, 1859, and used with success to drive screw-propellers.

My invention also has reference to a simpler form of suspending a piston in volumes of active fluid than those shown in my prior Letters Patent, No. 659,675, dated October 16, 1900.

The object of my invention is to provide a motor having all the effective features of a high-speed reciprocating crank-engine without containing the bad features thereof, it being practically an engine taking a medium position between the old-style reciprocating engines and the steam-turbines.

To this end my invention consists, essentially, in an engine, pump, or like apparatus comprising a casing, a shaft extending through said casing and rotatably mounted, a piston pivotally connected to oscillate about an axis at an angle to the shaft, and abutments on the sides of said piston engaged thereby, the adjacent or contacting surfaces of the piston and abutments being formed to run together and relatively forming, by means of projecting constituent noses, a plurality of pockets on the sides of the piston, gradually increasing and decreasing in volume on the same side of the piston during the cycle.

The nature of my invention will best be understood when described in connection with the accompanying drawings, in which—

Figure 1 represents a sectional elevation of a motor embodying my invention. Fig. 2 is a similar view, but showing the piston turned through an angle of about forty-five degrees from the position shown in Fig. 1. Fig. 3 is a sectional bottom view of Fig. 1. Fig. 4 is a sectional bottom view of Fig. 2. Fig. 5 is an elevation showing the parts in the same position as Fig. 1 and part of one of the abutments being broken away. Fig. 6 is an elevation showing the parts in the same position as in Fig. 4 and part of one of the abutments being broken away. Fig. 7 is a face view of the rotary oscillating piston. Fig. 8 is a face view of one of the valves. Fig. 9 is a side view of the same. Fig. 10 is an end view of the engine, partly in section.

Similar letters and numerals of reference designate corresponding parts throughout the several views of the drawings.

Referring to the drawings, the letter A designates a shaft mounted to rotate in suitable bearings 1 1, formed in a casing B, which is substantially in the form of a hollow sphere made in two parts flanged and bolted together in the usual manner. Upon the shaft A is mounted centrally with respect to the casing B a piston C, and within said piston are also located stationary abutments D and E, with which said piston is adapted to engage laterally. The piston C has a bearing upon a ball 2, which may be attached either to the shaft or form part of the same, and said piston is held to the shaft and to the ball by means of a pin 3, passing diametrically through said piston, the ball, and the shaft. This pin forms an axis about which the piston C can turn laterally—that is to say, it can oscillate while rotating. The pin 3 virtually forms a diameter of the casing B, and consequently the piston oscillates about an axis at right angles to the axis of the shaft. The abutments D and E are in the present instance each formed of a spherical sector fitting the casing B with its arched surface and terminating inwardly in a frustum of a cone. The planes of the bases and tops of the frustums of the abutments are parallel and form an angle with the axis of the shaft—that is to say, they extend obliquely to the shaft. The piston C is in the present example made discoidal in form and has its opposite faces inclined from two sides at an angle corresponding to that of the bases of the frustums, so that the adjacent or meeting surfaces come into close or smooth contact, as shown in Fig. 1. The faces of the piston are also hollowed out from its center to fit the formation of the frustums and is consequently formed with two projecting noses *a b*, located diametrically opposite to

each other. The abutments D and E, as will be seen from Fig. 1, are eccentrically mounted with respect to the shaft, the relative eccentricity in the present example being one hundred and eighty degrees.

In consequence of the above-described construction of the piston and abutments there will be formed between the piston and the abutments when the piston is in the position shown in Figs. 1 and 2 two pockets 4 and 5, which are diametrically opposite to each other on opposite sides of the piston; but as soon as the piston is slightly turned two additional pockets are formed—that is, there will now be two pockets on each side of the piston, of which two are continually increasing in volume and two decreasing in volume during the further rotation of the piston. It is evident that if actuating fluid be introduced into the two newly-forming pockets on opposite sides of the piston a rotation of the latter will be induced, together with an oscillation of the same about the pin or axis 3. The exhaust fluid is expelled from the gradually-decreasing pockets.

For the purpose of introducing actuating fluid—for instance, steam—into the pockets I make use of valves 6 and 7, located adjacent to the abutments D and E and mounted on the shaft A to rotate with the same. In the present example I have shown disk valves each having, as best seen in Figs. 8 and 9, two induction-ports 8 and 9 and two exhaust-ports 10 and 11, the exhaust-ports being formed on the periphery of the disks and the induction-ports in the body thereof. The actuating fluid is conducted to the valves through the pipes 12 and 13, communicating with the induction-ports 8 and 9, and the fluid passes from thence through channels 14 and 15, respectively, to the forming pockets. The channels 14 and 15 are formed in the abutments D and E and are branched, as shown in Figs. 3 and 6, and their intersection is controlled by a plug 19 for each abutment, so that the engine can be reversed by turning the plug so as to direct the incoming fluid through one channel or the other. When the plug is reversed or turned, the former fluid-channel is closed off. The main exhaust from the decreasing pockets takes place through the exhaust-pipes 20 and 21, which enter the casing B in position to communicate with said pockets. Of course but one set of exhausts—that is, one on each side of the piston—would be sufficient for a non-reversible engine. The exhaust-ports 10 and 11 in the valves 6 and 7 are connected by passages formed in the abutments with the pockets and serve for the discharge of the small quantity of fluid which may be confined between the piston and abutments just before the final disappearance of the decreasing pockets. The passages in the abutments I have designated by the numerals 22 and 23.

It will be readily understood from the foregoing that the piston is caused to assume a rotary oscillatory movement between the two abutments D and E and that, in view of the distribution of one pocket for live fluid and one pocket for exhaust fluid on each side of the piston, the piston is practically balanced and there is little or no friction between the contacting parts. Only such provision need therefore be made as will keep the parts tight.

The periphery of the piston is preferably arched to correspond to the arc of the casing and is provided with a packing—such, for instance, as a packing-ring ordinarily employed for pistons—and the noses of the piston may also be provided with a suitable packing.

While I have herein shown projecting noses, it is evident that yielding noses, such as shown in my prior patent and applications, could be employed. The valve-gear shown, of course, could be replaced by any other well-known form of gear.

It is obvious that the abutment-heads could be arranged to give way—that is to say, to move outwardly—for the purpose of permitting the passage of the noses on the piston while the latter rotates without oscillation. This construction would still involve the principle of the suspension of the piston and the oscillatory movement herein described.

The rotary oscillatory movement of the piston might be called "cycloidal," inasmuch as the piston rolls over a longer surface than its developed circumference, or the movement might also be called one of "nutation."

As the curved surfaces of the piston and abutments are always tangential to each other and time is given in changing from one angle to another by the forms of the lines embodied in the construction of the piston and abutments, there will be no bad or detrimental change of direction.

It is of course to be understood that the abutments could be made to rotate while the piston remains stationary and that the bases of the frustums of the cones of the abutments need not necessarily be parallel, and, furthermore, that a greater or less number of projecting noses could be employed on the piston.

What I claim as new is—

1. In an apparatus of the character specified, the combination of a casing, a shaft extending through said casing and rotatably mounted, a piston pivotally connected to oscillate about an axis at an angle to the shaft, and abutments on the sides of said piston engaged thereby; the adjacent or contacting surfaces of the piston and abutments being formed to run together and relatively forming by means of projecting constituent noses a plurality of pockets on the sides of the piston gradually increasing and decreasing in volume on the same side of the piston during the cycle.

2. In an apparatus of the character specified, the combination of a casing, a shaft extending through said casing and rotatably mounted, a piston pivotally connected to os-

cillate about an axis at an angle to the shaft, and abutments on the sides of said piston engaged thereby; the surfaces of the piston adjacent to the abutments having projecting constituent noses contacting with the abutments and forming a plurality of pockets on the sides of the piston gradually increasing and decreasing in volume on the same side of the piston during the cycle.

3. In an apparatus of the character specified, the combination of a casing, a shaft extending through said casing and rotatably mounted, a piston pivotally connected to oscillate about an axis at an angle to the shaft, abutments on the sides of said piston engaged thereby; the adjacent or contacting surfaces of the piston and abutments being formed to run together and relatively forming by means of projecting constituent noses a plurality of pockets on each side of the piston gradually increasing and decreasing in volume on the same side of the piston during the cycle, and means for reversing the direction of motion of the piston.

4. In an apparatus of the character specified, the combination of a casing, a shaft extending through said casing and rotatably mounted, a piston pivotally connected to oscillate about an axis at an angle to the shaft, abutments on the sides of said piston engaged thereby; the adjacent or contacting surfaces of the piston and abutments being formed to run together and relatively forming by means of projecting constituent noses a plurality of pockets on each side of the piston gradually increasing and decreasing in volume on the same side of the piston during the cycle, and means for supplying and exhausting fluid from the pockets.

5. In an apparatus of the character specified, the combination of a casing, a shaft extending through said casing and rotatably mounted, a discoidal piston having an arched periphery engaging with a corresponding internal arched surface of the casing and pivotally connected to oscillate about an axis at an angle to the shaft, and abutments on the sides of said piston engaged thereby; the adjacent or contacting surfaces of the piston and abutments being formed to run together and relatively forming by means of projecting constituent noses a plurality of pockets on the sides of the piston gradually increasing and decreasing in volume on the same side of the piston during the cycle.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FRED. W. JAEGER.

Witnesses:
EUGENIE P. HENDRICKSON,
FRED HACHENBERG.